

Supporting the information technology industry with measurements, standards, and research...



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General Guiding Themes

Mission:

Provide the networking industry with the best in test and measurement research.

Goals:

- **To improve the quality of emerging networking specifications and standards.**
- **To improve the quality of networking products based on public specifications.**

Core Technical Contributions:

- **Modeling and analysis from specifications to assess consistency, completeness, precision, and performance characteristics**
- **Prototyping and empirical studies from specifications to determine feasibility**
- **Developing test and measurement tools, techniques, metrics, and data to assess conformance, interoperability, and performance**

Current Organization of ANTD



"Innovating Network Metrology"

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Division
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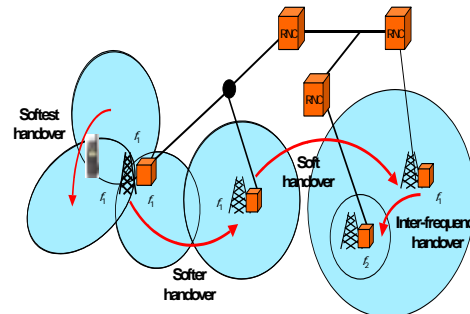
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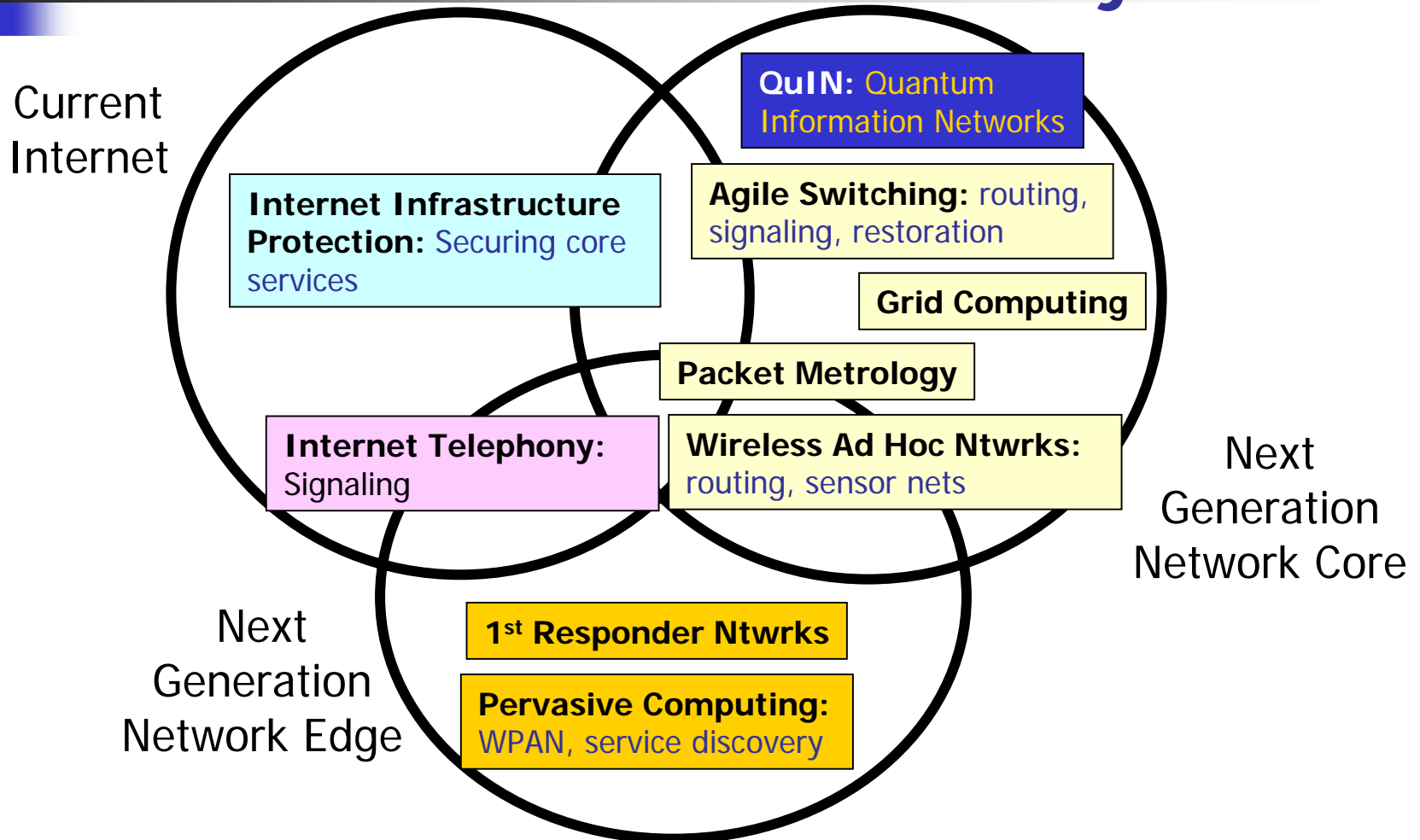
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ANTD

Research Areas & Projects





Agile Switching Infrastructure

- Main Focus: (1) Standards for optical network protection & restoration, (2) technologies for optical burst switching (OBS).
- Planned Accomplishments:
 - Standards for optical network protection & restoration
 - Provide quantitative analyses of mechanisms and protocols under development by OIF and IETF – assess performance and examine impact of large-scale failures.
 - Provide report on multi-layer restoration mechanisms - determine decision thresholds for escalation to upper layers and examine interactions between layers in various restoration scenarios
 - Technologies for optical burst switching
 - Enhance GLASS to enable simulation of optical burst switching.
 - Conduct performance evaluation of OBS techniques
 - Explore Architecture of GMPLS over OBS – assess how might OBS effect Traffic Engineering and restoration mechanisms, and determine how might GMPLS be extended to support OBS.
- Expected Impact: Expedite development of standards for agile, fault-tolerant optical networks.



Networking for Pervasive Computing

- Main Focus: **Real-Time Measurement & Self-Adaptation**
- Planned Accomplishments:
 - **Wireless Personal-Area Networks (WPANs)**
 - Study additional interference scenarios with realistic traffic (e.g., FTP, MP3, HTTP traces from real WLAN connections) and analyze the impact of interference mitigation techniques on transport and network protocols (i.e., TCP/IP)
 - Investigate coexistence issues and standardization of other technologies for WPANs (e.g., Ultra-Wide Band and low-rate sensor networks)
 - **Service-Discovery Protocols (SDPs)**
 - Analyze robustness of service-discovery protocols during node failure (with 897)
 - Complete discrete-event simulation model for SLP (as suggested by NRC Panel)
 - Propose, model, and evaluate additional self-adaptive mechanisms (per DARPA FTN)
 - Complete and publish generic model of discovery protocols (with 897)
- Expected Impact: **Help industry to understand and mitigate performance degradation arising from increased volatility along the edges of tomorrow's Internet.**



Internet Infrastructure Protection

- Main Focus: Improving the agility, performance, and scalability of network security services. Expediting the development of Internet infrastructure protection technologies
- Planned Accomplishments:
 - Foster Standardized Internet Security Services
 - Lead the completion of the AES IPsec/IKE specifications (IETF, vendors).
 - Model and analyze design trade offs in IETF Son-of-IKE deliberations (IETF).
 - Complete and publicly release IKE/IPSec simulation framework (R&D).
 - Develop modeling tools for security policy management protocols. Analyze the performance in multi-domain DDos mitigation scenarios. (DARPA FTN)
 - Research and design IPSec/IKE extensions to exploit Quantum Key Distribution Technologies (IETF, QuIST).
 - Expedite Infrastructure Protection Technologies
 - Lead the completion of the DNS Sec specifications. (IETF, ISPs).
 - Complete and publish DNS Sec performance analysis (IETF, ISPs)
 - Analyze threat models and security / protection mechanisms for SIP based services, including network device control and PSTN gateways.
- Expected Impact: Help industry to expedite the design, analysis, and standardization of key Internet security technologies.



Quantum Information Networks

- Main Focus: To investigate the applicability of quantum computing (QC) technology to information networks and to distributed systems.
- Planned Accomplishments:
 - Develop a quantum information network (QuIN) testbed, prototype quantum key distribution protocols, and evaluate their performance.
 - Integrate QuIN transmission and protocol technologies with traditional network and security systems.
 - Research and design IPSec/IKE extensions to exploit Quantum Key Distribution Technologies.
- Expected Impact: Increased understanding of quantum computing technology.



Wireless Ad Hoc Networks

- Main Focus: (1) Standards for WANETs, (2) video communications for sensor networks, and (3) smart antenna techniques for WANETs.
- Planned Accomplishments:
 - Contribute to IETF standardization process for ad hoc routing protocols by further completing AODVjr and promoting it in IETF.
 - Meet the objectives of DARPA SensIT project by fine tuning the mobile ad hoc video communication network and transferring the technology to DARPA.
 - Evaluate applicability and effectiveness of smart antenna techniques in WANETs.
- Expected Impact: Expedite deployment of WANETs for various applications by facilitating the standardization process and solving a number of open problems.



Internet Telephony/Signaling

- Main Focus: Test and measurement techniques to expand the scope and application of SIP-based technology
- Planned Accomplishments:
 - Programmable SIP Signaling Services / Platforms
 - Lead Java/JAIN standardization and test development efforts for JAIN/SIP and JAIN/SIP-LITE (Java JAIN community).
 - Complete effort to prototype and evaluate resource control mechanisms for programmable service creation environments (DARPA Anets, IETF).
 - Incorporate service creation technology into NIST SIP-WIT enabling user programmable test cases (IETF community).
 - Expanding SIP's Scope and Application
 - Complete and release NIST-SIP-LITE J2ME prototype, evaluate applicability to embedded devices (Java JAIN, 3GPP).
 - Analyze security / protection mechanisms required to enable SIP based wide area control of network appliances & building service gateways. (IETF, OSGi).
 - Significantly expand NIST SIP-WIT test scenarios / services (IETF).
- Expected Impact: Help industry to expedite the design, analysis, and standardization of new SIP based technologies. Deliver research platforms and testing services to R&D community.



First Responder Networks

- Main Focus: Development of a robust, resilient, interoperable, highly capable network for communications and sensing for various first responder groups.
- Planned Accomplishments:
 - Develop WANET testbed with both communication and sensing capability for 1st responders in collaboration with BFRL and MEL.
 - Test and measure performance of 3-D localization techniques to find objects within buildings and buried in debris.
 - Carry out a study for DARPA NETEX Program on merits, drawbacks, and applications of UWB technologies in homeland security.
- Expected Impact: Saving lives through standards for next generation first responder networks.



Packet Metrology

- Main Focus: Explore the application of new generation of specialized network processor technologies for network metrology.
- Planned Accomplishments:
 - Design and implement packet sampling framework and reporting software using off-the-shelf components and available development toolkits.
 - Develop and characterize real-time packet-metrology mechanisms for high-speed networks.
 - Conduct performance studies and contribute results to IETF.
 - Publish data, analysis methods, and software tools.
- Expected Impact: Hasten the deployment of an effective set of standard measurement solutions and tools for the next generation Internet backbone.



Grid Computing

- Main Focus: Can we understand global effects arising from collective dynamics in the emerging web-services grid?
- Planned Accomplishments:
 - Design a mathematically abstract simulation model to represent a networked computing grid.
 - Characterize architectural choices for web-services, e.g., deployment, replication, composition, and error response.
 - Devise traffic models to represent web clients.
 - Develop a prototype model of a web-services grid.
 - Run trial experiments to investigate feasibility and utility.
- Expected Impact: Seminal work to investigate emergent behavior in the global information grid. New tools and techniques to conceive, model, and analyze collective dynamics in large-scale distributed systems



Tools for Network R&D

Agile Switching

GLASS- GMPLS/Optical network Simulation Tool – tool for design and evaluation of dynamic control algorithms for traffic engineering, intrusion detection and fault tolerance in integrated MPLS / optical networks – <http://www.antd.nist.gov/glass/>

NIST Switch: MPLS Research Platform – <http://www.antd.nist.gov/itg/nistswitch/>

Networking for Pervasive Computing

Coexistence models for Bluetooth and WLAN – MAC and PHY layer simulation models (OPNet) to evaluate the impact of interference on the performance of Bluetooth and WLAN networks.

http://w3.antd.nist.gov/wlan_wpan.shtml

C++ Software modeling tool for physical layers of Bluetooth and IEEE 802.11 (1 and 11 Mb/s):

<http://w3.antd.nist.gov/wctg/bluetooth/btint.html>

Universal Plug-and-Play, Version 1.0, Discrete-Event Simulation Model written in SLX.

Jini™, Version 1.1, Discrete-Event Simulation Model written in SLX.

Internet Security

Cerberus/PlutoPlus: - IPsec/IKE reference implementation

<http://www.antd.nist.gov/cerberus/>

IPsec-WIT: Web based IPsec/IKE interoperability test system

<http://ipsec-wit.antd.nist.gov/>



Tools for Network R&D (2)

Internet Telephony

NIST-SIP – Research platform and reference implementation of a JAIN/SIP compliant signaling stack, extensible message parser, scripting environment for call flow generation.

<http://www.antd.nist.gov/proj/iptel/>.

SIP-WIT – WWW-based SIP interoperability test system <http://sip-wit.antd.nist.gov/>

Internet Quality of Service

NIST-Net – NIST Network Emulation Tool <http://www.antd.nist.gov/itg/nistnet/>

Wireless Ad Hoc Networks

Kernel Implementation of AODV Ad Hoc routing protocol: http://w3.antd.nist.gov/wctg/aodv_kernel/

OPNET model for MANET AODV routing protocol:

http://w3.antd.nist.gov/wctg/manet/prd_aodvfiles.html

Spreadsheet application for calculation of outdoor propagation loss:

http://w3.antd.nist.gov/wctg/manet/prd_propcalc.html

3G Wireless

SPW models for reverse link of cdma2000 system and its associated link budget (Developed in collaboration with Cadence Design Systems, Inc.):

http://w3.antd.nist.gov/wctg/3G/cdmar2000_form.shtml



Papers

Networking for Pervasive Computing

- N. Golmie, "Performance Evaluation of a Bluetooth Channel Estimation Algorithm," to appear in the Proceedings of the 13th IEEE International Symposium on Personal Indoor, and Mobile Radio Communications, PIMRC 2002 , Lisbon, Portugal, Sept. 15-18, 2002.
- A. Soltanian, R. E. Van Dyck, and O. Rebala, "Rejection of Bluetooth Interference in 802.11 WLANs," to appear in IEEE Vehicular echnology Conference Fall, Vancouver, Canada, Sept. 2002.
- C. Dabrowski, K. Mills, and J.Elder, "Understanding Consistency Maintenance in Service Discovery Architectures during Communication Failure“, to appear in *The Proceedings of the Third International Workshop on Software Performance (WOSP 2002)*, Rome, Italy, July 2002.
- C. Dabrowski, K. Mills, and J.Elder, "Understanding Consistency Maintenance in Service Discovery Architectures in Response to Message Loss“, to appear in *The Proceedings of the Fourth International Workshop on Advanced Middleware Services (WAMS 2002)*, Edinburgh, Scotland, July 2002.
- K. Mills and C. Dabrowksi, "Adaptive Jitter Control for UPnP M-Search“, to be submitted to an international conference, during summer 2002.



Papers

Networking for Pervasive Computing (continued)

- N. Golmie, O. Rebala, "Bluetooth Dynamic Scheduling and Interference Mitigation, submitted for review to ACM/MONET'02, 2002.
- N. Golmie, R. E. Van Dyck, A. Soltanian, A. Tonnerre, and O. Rebala, "Interference Evaluation of Bluetooth and IEEE 802.11b Systems," to appear in special issue of *ACM Wireless Networks* 2002.
- K. Mills and J. Scholtz, "Situated Computing: The Next Frontier from HCI Research", Chapter 24 in *Human-Computer Interaction in the New Millennium*, (John M. Carroll, editor), ACM Press, Addison-Wesley, New York, 2002.
- Christopher Dabrowski and Kevin Mills, "Analyzing Properties and Behavior of Service Discovery Protocols using an Architecture-based Approach", *Proceedings of Working Conference on Complex and Dynamic Systems Architecture*, December 2001.
- N. Golmie, N. Chevrollier, I. ElBakkouri, "Interference Aware Bluetooth Packet Scheduling," *Proceedings of IEEE GLOBECOM '01*, Volume: 5 , 2001, pp. 2857-2863, San Antonio, TX, Nov. 2001.



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Networking for Pervasive Computing (continued)

- A. Soltanian and R. E. Van Dyck, "Performance of the Bluetooth System in Fading Dispersive Channels and Interference," *Proceedings IEEE GLOBECOM '01*, San Antonio, TX, pp. 3499-3503, Nov. 2001.
- N. Golmie, R. E. Van Dyck, and A. Soltanian, "Interference of Bluetooth and IEEE 802.11: Simulation Modeling and Performance Evaluation," *Proceedings ACM Int. Workshop on Modeling, Analysis, and Simulation of Wireless and Mobile Systems*, Rome, Italy, pp. 11-18, July 2001.
- A. Soltanian and R. E. Van Dyck, "Physical Layer Performance for Coexistence of Bluetooth and IEEE 802.11b," *Proceedings 2001 Virginia Tech. Symposium on Wireless Personal Communications*, Blacksburg, VA, pp. 31-41, June 2001.
- N. Golmie, F. Mouveaux, "Interference in the 2.4 GHz ISM Band: Impact on the Bluetooth Access Control Performance," *Proceedings of the 18th Int'l Conference on Communications*, ICC'01, June 11-15, 2001, Helsinki, Finland.



Papers

Agile Switching and Optical Networks

- Byung-Chul Kim, Johg-Hyup Lee, You-Ze Cho, and Doug Montgomery, "Performance of Optical Burst Switching Techniques in Multi-Hop Networks", accepted for publication at GlobeCom'02, Nov. 2002, Taipei.
- D. Griffith and S.K. Lee, "Dynamic Expansion of M:N Protection Groups in GMPLS Optical Networks," accepted for Workshop on Optical Networks, WON'02, Aug 18, 2002, Vancouver, Canada.
- S.K. Lee, C. Kim, and D. Griffith, "Hierarchical Restoration Scheme for Multiple Failures in GMPLS Networks," accepted for Workshop on Optical Networks, WON'02, Aug 18, 2002, Vancouver, Canada.
- J.K. Patel, S.U. Kim, and D. Su, "QoS Recovery Schemes Based on Differentiated MPLS Services in All-Optical Transport Next Generation Internet," Photonic Network Communications, vol 4, no. 1, pp. 5-18, Jan. 2002.
- Byung-Chul Kim, Johg-Hyup Lee, You-Ze Cho, and Doug Montgomery, "A Novel Hop-by-Hop Priority Increasing Scheme for Multi-Hop Optical Burst Switching Networks", accepted for publication at the International Conference on Optical Internet (COIN), July 21-25, 2002, Cheju Island, Korea.



Papers

Agile Switching and Optical Networks (continued)

- E. Lim, Y.T. Kim, and D. Montgomery, "Discrete Event Simulation of DiffServ-over-MPLS with the NIST GMPLS Networking Simulation Tool," The 12th Joint Conference on Communications and Information(JCCI), April 24, 2002, Jeju, Korea.
- E. Lim, Y.T. Kim, and D. Montgomery, "Discrete Event Simulation of the DiffServ-over-MPLS with the NIST GMPLS Networking Simulation Tool.," The 12th Joint Conference on Communications and Information(JCCI), April 24, 2002, Jeju, Korea
- S.K. Lee, D. Griffith, and N.O. Song, "A New Analytical Model of Shared Backup Path Provisioning in GMPLS Networks", *Photonic Network Communications*, Mar/Apr 2002, pp.271-283.
- V. Marbukh, "A Framework for Combining Long and Short Time-Scale Traffic Engineering for MPLS", *Proceedings of 6th INFORMS Telecommunications Conference 2002*, March 2002.
- S.K. Lee, D. Griffith, and V. Coussot, "ER-LSP Set-up for Multi-Service in Lambda Labeling Networks", *Proceedings of IEEE Globecom'01*, vol. 1, pp 81-85, Nov. 2001.
- V. Marbukh, "Minimum Regret Approach to Network Management under Uncertainty with Applications to Connection Admission Control and Routing", *Proceedings of ICN 2001*, Oct. 2001, part II, pp. 308-318.
- J.K.Patel, S.U. Kim, and D. Su, "A Framework for Managing Faults and Attacks in WDM Optical Networks," *Proceedings of DARPA Information Survivability Conference and Exposition (DISCEX 2001)*, June 12-14, 2001, vol. II, pp. 137-145.



Papers

Wireless

- L. E. Miller and B. J. Kwak, "Cumulative Acknowledgement Multicast Repetition Policy for Wireless LANs or Ad Hoc Network Clusters, " accepted for presentation at ICC 2002.
- W. Zhang and N. Moayeri, "Closed Form Expressions for the Prediction of Micro-Cellular Mobile Radio Propagation in Urban Environments," to appear in *IEEE Transactions on Antennas and Propagation*, 2002.
- H. Gharavi, R. Wyatt-Millington, and F. Chin, "Design, Model Implementation, and Evaluations of the cdma2000 Reverse-Link, " accepted for publication in *Journal of Research of the National Institute of Standards and Technology*, 2002.
- K. Ban and H. Gharavi (invited paper), "Video Transmission for Multi-hop Networks Using IEEE 802.11 FHSS," *2002 IEEE Int. Conf. Image Processing*, Rochester, NY, Sept. 2002.
- C. Gentile, J. Haerri, R. E. Van Dyck, "Kinetic Minimum-Power Routing and Clustering in Mobile Ad-Hoc Networks," accepted for presentation at *IEEE VTC Fall*, Vancouver, Canada, Sept. 2002.
- H. Gharavi and K. Ban, "Mobile Ad-hoc Network Design for Handheld Multimedia Communications," invited paper, to be published in *Proceedings of IEEE 2002 International conference on image processing*, Sept. 2002.



Papers

Wireless (continued)

- J. Song and L. E. Miller, "Empirical Analysis of the Mobility Factor for the Random Waypoint Mobility Model," accepted for presentation at OPNETWork 2002, Washington, DC, Aug. 2002.
- R. E. Van Dyck, "Detection performance in self-organized wireless sensor networks," submitted to *IEEE Int. Symp. on Information Theory*, Lausanne, Switzerland, June-July 2002.
- I. Chakeres (UCSB) and L. Klein-Berndt, "AODVjr," *AODV Next Generation (AODVng) 2002 Workshop, Lausanne, Switzerland, June 2002*.
- K. Ban and H. Gharavi, "IEEE 802.11 FHSS receiver design for multihop sensor application," *Proceedings of 2002 International conference on broadband wireless access systems*, May 28-31, 2002.
- H. Gharavi and K. Ban, "Vision-Based Ad-hoc Sensor Networks for Tactical Operations," *World Wireless Congress, 3Gwireless'2002*, San Francisco, CA, May 2002.
- H. Gharavi and K. Ban, "Video Transmission for Multi-hop Sensor Networks using IEEE 802.11 FHSS," 2002 International conference on broadband wireless access systems," tbe published in *Proceedings of 2002 International conference on third generation wireless and beyond*, May 28-31, 2002.



Papers

Programmable Networks

- V. Galtier, K. Mills, and Y. Carlinet, "Modeling CPU Demand in Heterogeneous Active Networks", *Proceedings of the DARPA Active Networks Conference and Exposition*, IEEE, June 2002.
- V. Galtier, K. Mills, Y. Carlinet (NIST) and S. Bush and A. Kulkarni (GE), "Predicting and Controlling Resource Usage in a Heterogeneous Active Network", *Proceedings of the 3rd International Workshop on Active Middleware Systems*, Aug. 2001.
- V. Galtier, K. Mills, Y. Carlinet (NIST) and S. Bush and A. Kulkarni (GE), "Predicting and Resource Demand in Heterogeneous Active Networks", *Proceedings of IEEE MILCOM 2001*, Oct. 2001.

Network Modeling

- J. Yuan and K. Mills, "Exploring Collective Dynamics in Communication Networks", *The Journal of NIST Research*, Volume 107, Number 2, pp.179-191, March-April, 2002.

Internet Telephony

- T. A. Hall, "Objective Speech Quality Measures for Internet Telephony," in Voice over IP (VoIP) Technology, Petros Mouchtaris, Editor, *Proceedings of SPIE*, vol. 4522, Denver, CO, Aug. 2001.



Papers

Other Topics

- K. Mills and H. Gomaa, "Knowledge-based Automation of a Design Method for Concurrent Systems", *IEEE Transactions on Software Engineering*, in press, scheduled for Vol. 28 Issue 2, March 2002.
- ST. Kim (Intel), R. E. Van Dyck (NIST), and D. J. Miller (Penn State), "Hybrid fractal zerotree wavelet image coding," to appear in *Signal Processing: Image Communication*, 2002.
- T. Kim (Intel) , R. E. Van Dyck (NIST), and D. J. Miller (Penn State), "Robust fractal zerotree wavelet image coding for noisy channel transport," submitted to *IEEE Trans. on Image Processing*, 2002.
- C. Gentile and M. Sznaiier (Penn State), "An Improved Voronoi-Diagram-Based Neural Net for Pattern Classification", *IEEE Trans. Neural Networks*, vol. 12, no. 5, Sept. 2001. Presence of Severe Occlusion", *Proceedings of IEEE CVPR*, Kauai, HI, December 2001, also submitted to *IEEE Trans. Image Processing*, June 2002.
- .C. Gentile and M. Sznaiier, "Hyperborders in the Voronoi-Diagram-Based Neural Net for Pattern Classification," *Proceedings of IJCNN*, Honolulu, HI, May 2002.
- S. Mahapakulchai (Penn State) and R. E. Van Dyck, "Design of Ring Convolutional Trellis Codes for MAP Decoding of MPEG-4 Imagery," *Proc. of IEEE Int. Conf. Comm. (ICC'01)*, Helsinki, Finland, June 2001. Also submitted to *IEEE Trans. Comm.* , 2002.



Papers

Other Topics (continued)

- Y. Wang (Penn State), J. F. Doherty (Penn State), and R. E. Van Dyck (NIST), "A rotation, scaling, and translation resilient image watermarking algorithm using circular Gaussian filters," *Proceedings IEEE-EURASIP Workshop on Nonlinear Signal and Image Processing*, Baltimore, MD, June 2001.
- C. Gentile and M. Sznaier (Penn State), "Hyperborders in the Voronoi-Diagram-Based Neural Net for Pattern Classification," *Proc. IJCNN*, Honolulu, HI, pp. 2231-2236, May 2002.
- Y. Wang (Penn State), J. F. Doherty (Penn State), and R. E. Van Dyck, "A Wavelet-Based Watermarking Algorithm for Copyright Protection of Digital Images," *IEEE Trans. Image Processing*, vol. 11, no. 2, pp. 77-88, Feb. 2002.
- T. Kim (Intel), S.-K. Choi (Penn State), R. E. Van Dyck, and N. K. Bose (Penn State), "Classified Zerotree Wavelet Image Coding and Adaptive Packetization for Low Bit Rate Transport," *IEEE Trans. CSVT*, vol. 11, no. 9, pp. 1022-1034, Sept. 2001.
- H. Gharavi H. Reza-Alikhani, "Pel Recursive Motion Estimation Algorithm," *Electronic Letters* 37: (21), pp. 1285 –1286, Oct. 2001.



Standards Contributions

Networking for Pervasive Computing

- "MAC Scheduling Mechanisms," N. Golmie, IEEE 802.15/02-036r2, Dallas, TX, Jan. 2002.
- "MAC Scheduling Mechanisms," N. Golmie, IEEE 802.15/01-316r1, Portland OR, July 2001.
- "MAC Modeling and Simulation Results," N. Golmie, IEEE 802.15/01-317r1, Portland OR, July 2001.
- "Coexistence Modeling Overview," N. Golmie, IEEE 802.15/01-318r1, Portland OR, July 2001.
- "Interference Aware Bluetooth Scheduling Techniques," N. Golmie, IEEE 802.15/01-143r0, Hitlon Head, NC, March 2001.
- "Bluetooth and 802.11b Interference: Simulation Model and System Results," N. Golmie, R. E. Van Dyck, A. Soltanian, IEEE 802.15/01-195r0, April 2001.
- "Bluetooth Interference with 802.11 DS: MAC Simulation Results," N. Golmie, IEEE 802.15/01-077r0, Jan. 2001, Monterey, CA.
- "Power Control and Packet Scheduling for Bluetooth to Avoid 802.11 Direct Sequence Interference," N. Golmie and N. Chevrollier, IEEE 802.15/01-063r0, Jan. 2001, Monterey, CA.
- "802.11b Deterministic Frequency Nulling to Mitigate Bluetooth Interference," R. E. Van Dyck and A. Soltanian, IEEE 802.15/01079r0, Monterey, CA, Jan. 2001.



Standards Contributions

Agile Switching Infrastructures

- "Inference of Shared Risk Link Groups", Dimitri Papadimitriou, D. Griffith, et. al, 11/28/2001, IETF Internet Draft <draft-many-inference-srlg-02.txt>
- "Restoration Mechanisms and Signaling in Optical Networks", Jin-Ho Hahm, Kwang-il Lee, David Griffith, et al, 11/30/2001, IETF Internet Draft <draft-many-optical-restoration-01.txt>
- "A Comparison of RSVP-TE and CR-LDP," D. Griffith, OIF Forum oif2000.179.00, August 11, 2000.
- "A List of IETF Drafts that May Affect OIF NNI Work," D. Griffith, OIF Forum oif2001.318.00, July 6, 2001.
- "A Summary of IETF Work that Impacts the NNI," D. Griffith, OIF Forum oif2001.408.00, July 31, 2001.
- "IETF Work and the UNI in All-Optical Networks," D. Griffith, OIF Forum oif2001.415.00, August 1, 2001.



Standards Contributions

Internet Infrastructure Protection

- "The AES Cipher Algorithms and Their Use With IPsec", R. Glenn, Sheila Frankel, Scott Kelly, 11/28/2001, IETF Internet Draft <draft-ietf-ipsec-ciph-aes-cbc-03.txt>
- "The AES-XCBC-MAC-96 Algorithm and Its Use With IPsec", Sheila Frankel, Howard Herbert, 11/16/2001, IETF Internet Draft <draft-ietf-ipsec-ciph-aes-xcbc-mac-00.txt>
- "The HMAC-SHA-256-96 Algorithm and Its Use With IPsec ", Sheila Frankel, Scott Kelly, 11/16/2001, IETF Internet Draft <draft-ietf-ipsec-ciph-sha-256-00.txt>
- "DNS Security Document Roadmap", Scott Rose, 11/26/2001, IETF Internet Draft <draft-ietf-dnsext-dnssec-roadmap-05.txt>
- "DNS Security Introduction and Requirements", D Massey, Scott Rose, 07/16/2001, IETF Internet Draft <draft-ietf-dnsext-dnssec-intro-00.txt>
- "Limiting the Scope of the KEY Resource Record", D Massey, Scott Rose, 01/23/2002, IETF Internet Draft <draft-ietf-dnsext-restrict-key-for-dnssec-01.txt>